

Appl. No. 10/820,856
Amendment dated: January 28, 2008
Reply to OA of: October 29, 2007

REMARKS

Applicants have amended the claims to more particularly define the invention taking into consideration the outstanding Official Action. Applicants have added new claims 22 to 26 to the present application to better define the invention (see paragraph 0019 for support). Applicants submit that the claims now present in the application are fully supported by the specification as originally filed and no new matter is introduced.

Applicants most respectfully submit that all of the claims now present in the application are in full compliance with 35 USC 112 and clearly patentable over the references of record.

The rejection of claims 1 and 4 under 35 USC 102(b) as being anticipated by Mis et al. has been carefully considered but is most respectfully traversed in view of the following comments.

Applicants wish to direct the Examiner's attention to MPEP § 2131 which states that to anticipate a claim, the reference must teach every element of the claim.

"A claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference." *Verdegaal Bros. v. Union Oil Co. of California*, 814 F.2d 628, 631, 2 USPQ2d 1051, 1053 (Fed. Cir. 1987). "The identical invention must be shown in as complete detail as is contained in the ... claim." *Richardson v. Suzuki Motor Co.*, 868 F.2d 1226, 1236, 9 USPQ2d 1913, 1920 (Fed. Cir. 1989). The elements must be arranged as required by the claim, but this is not an *ipsissimis verbis* test, i.e., identity of terminology is not required. *In re Bond*, 910 F.2d 831, 15 USPQ2d 1566 (Fed.Cir. 1990).

In this regard, Column 5, line 60 to line 67 of the Mis reference (U.S. 5,767,010) discloses that the solder reacts with a portion of the copper layer 34 to form intermetallic region 34' after reflowing, and this intermetallic region 34' may include Cu₃Sn. It shows that the intermetallic region 34' is chemical compounds formed by copper and tin. Because of the Cu₃Sn is intermetallic compound, so that the Cu₃Sn is not only chemically different from copper and tin, but also different from the tin-copper alloy.

Furthermore, in the flip chip packaging, along the Cu₃Sn/Cu interface, Applicants can find a series of Kirkendall's voids. These Kirkendall's voids were the true culprit responsible for the weakening of the interface. It is widely accepted that the formation

Appl. No. 10/820,856
Amendment dated: January 28, 2008
Reply to OA of: October 29, 2007

of these Kirkendall's voids is related to the growth of Cu_3Sn .

In claim 1 of the present invention, the material of the second barrier layer comprises tin and copper. Tin and copper of the second barrier layer are not fully reacted with each other, and the quantity of copper is larger than that of tin so as to prevent discontinuous blocks (intermetallic compound) from forming in the first barrier layer of the under bump metallization structure.

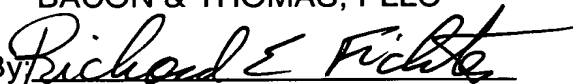
Further, in claim 22 of the present invention, the second barrier layer is tin-copper alloy, and Cu_3Sn of the Mis reference is not the same with the tin-copper alloy. It is clear that the purpose of the tin-copper alloy in the present invention, and the Mis reference (U.S. 5,767,010) fails to disclose about this feature. Accordingly, it is most respectfully requested that this rejection be withdrawn.

The rejection of claim 3 under 35 USC 103(a) as being unpatentable over Mis, as applied to claim 1 above, and further in view of Michael has been carefully considered but is most respectfully traversed in view of the above comments. The Michael reference does not overcome the deficiencies of the primary reference as discussed above. Accordingly, it is most respectfully requested that this rejection be withdrawn.

The rejection of claims 7, 20 and 21 under 35 USC 103(a) as being unpatentable over Mis as applied to claim 1 above has been carefully considered but is most respectfully traversed in view of the above comments. Accordingly, it is most respectfully requested that this rejection be withdrawn.

In view of the above comments and further amendments to the claims, favorable reconsideration and allowance of all of the claims now present in the application are most respectfully requested.

Respectfully submitted,
BACON & THOMAS, PLLC

By 
Richard E. Fichter
Registration No. 26,382

625 Slaters Lane, 4th Fl.
Alexandria, Virginia 22314
Phone: (703) 683-0500
Facsimile: (703) 683-1080
REF/cmd/cjw
A04.wpd
January 28, 2008